*International Civil Aviation Organization*

**FOURTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND METEOROLOGY SUB-GROUP OF APANPIRG (CNS/MET SG/14)**

Jakarta, Indonesia, 19 – 22 July 2010

**Agenda Item 14: Regional MET support to ATM**
**(2): Exchange of information on MET support for operations at aerodromes, terminal areas and en-route**

# DEVELOPMENT OF NEW SIGNIFICANT CONVECTION FORECAST PRODUCT AND SERVICE FOR AIR TRAFFIC FLOW MANAGEMENT IN HONG KONG, CHINA

(Presented by Hong Kong, China)

**SUMMARY**

This paper presents the latest development of significant convection forecast product by the Hong Kong Observatory (HKO) and the weather briefing service for ATC in support of Air Traffic Flow Management (ATFM) in Hong Kong, China.

This paper relates to:

**Strategic Objectives:**
A. Safety – Enhance global civil aviation safety
D. Efficiency – Enhance the efficiency of aviation operations

**Global Plan Initiatives:**
GPI-18 Aeronautical Information
GPI-19 Meteorological Systems

## 1. Introduction

1.1 With increasing air traffic in the Asian region, close coordination between ATC flow control units of adjacent FIRs is inevitable. To better plan and manage the air traffic flow within the FIR, appropriate flow control measures need to be taken by the responsible ATC with a view to reducing flight delays and diversions, maximizing capacity and optimizing the flow of air traffic within the FIR.

1.2 In the Asian region, the development of organized significant convection is usually associated with frontal systems in spring, monsoon trough and tropical cyclones in summer. The Hong Kong FIR (HKFIR) spans over the northern part of the South China Sea. Significant air traffic disruption will occur when significant convection affects key ATC areas such as major holding areas for arrival flights to the east and south of Hong Kong as well as the boundary zones over the northern and southern parts of the HKFIR where flight level selection is required for in-bound and out-bound flights in severe weather situations.

1.3 We presented the Observatory's planned provision of weather briefing service to ATC in support of ATFM at the MET/ATM TF/1 meeting. This paper provides an update of the latest development on the MET products and services to meet ATFM needs and requirements in Hong Kong, China.

## 2. Development of new significant convection forecast product and service

2.1 At the request of ATC in Hong Kong, China, HKO provides regular weather briefings to cover significant convection forecast for HKFIR for the next 12 hours with a focus on the key ATC areas and the next 6 hours. The objective is to facilitate ATC personnel in planning air traffic flow and making informed decisions on exercising flow control measures in anticipation of significant weather in the next few hours. A series of preparation steps were taken by HKO before the commencement of the trial weather briefing in June 2010.

2.2 To facilitate the conduct of weather briefings, new significant convection forecast product and an integrated web-based monitoring and forecast display were designed in consultation with the ATC personnel. It is beneficial to engage users as early as in the product development stage in order to ensure their buy-in of the product.

2.3 An integrated web-based display of significant convection monitoring and forecast tailored for ATC was developed with users' comments incorporated. The layout of the display is given in Figure 1. In the display, animation of past-hour radar image at 6-minute intervals with inclusion of ATC sector boundaries and checkpoints is shown. Users can select overlay of lightning location data onto different ranges (64-, 128-, 256-km) of radar image. It facilitates the monitoring of the development and movement of significant convection in the vicinity of the aerodrome and key holding areas for arrival flights.

2.4 Another product in the display is the overlay of radar images and ATC sector boundaries onto satellite image of potential deep convection. In the satellite image, potential deep convection areas are highlighting in bright white color to facilitate monitoring of significant convection over a larger area covering the whole HKFIR and its vicinity. The composite images are displayed in an animation loop for the past 3 hours at half-hourly intervals.

2.5 The integrated web-based display also features graphical significant convection forecasts in the form of time series (Figure 2) and "weather map"/"areal map" (Figure 3). They were developed based on objective guidance including numerical weather prediction model outputs from ECMWF. The forecast is updated every 3 hours up to 12 hours ahead. To align with forecaster's assessment based on meteorological observations and analysis including radar and satellite observations, manual adjustment to the automatically generated forecast for the first few hours may be applied when situation warrants.

2.6 Joint workshops for ATC personnel and aviation forecasters were held before and after the launch of the new forecast products and display. The workshop provided an excellent platform for interactions and open discussion between ATC personnel and aviation forecasters. It enhanced aviation forecasters' understanding of the need of weather information for ATFM and the importance of the weather information for the key ATC areas. Objective and subjective verification results of significant convection forecast, though with limited number of cases during the trial period,

were presented at the workshop to enable ATC personnel to have a better understanding on the level of forecast accuracy. It is expected that ATC personnel will undergo an adaptation and "learning" period to utilize the trial forecast in imposing flow control measures.

## 3. Future work

3.1 On the operational side, the next step is to coordinate with ATC in systematically evaluating the performance of significant convection forecast taking into consideration the impact to air traffic flow. The weather briefing service will be reviewed together with ATC. There is a plan to cover detailed aerodrome forecast in the next 9 hours or so in the weather briefings for weather elements impacting the operating mode of runways and reaching user-defined thresholds so as to facilitate ATC estimation of runway capacity and planning for ATFM.

3.2 On the development side, further enhancements to the integrated monitoring and forecast display will be made with the inclusion of radar echo top height information and overlay of HKO tropical cyclone forecast track on the composite satellite and radar image. The algorithms for defining the color scale of significant convection forecast will be tuned based on the availability of more air traffic flow data for significant events. The objective method for generating the first guess of convection forecast will be enhanced with additional model outputs and the combined use of nowcasting techniques based on radar and satellite observations. The aim is to improve forecast performance, enabling tie-in of the forecast with ATC decision on exercising air traffic flow control measures. At that time, translation of the forecast product into airspace capacity forecast for use by ATC will be explored. Additional terminal area forecasts and probabilistic forecast of flight delay will also be explored for use by airline users and pilots.

## 4. Action by the Meeting

4.1 The meeting is invited to note the information in this paper.

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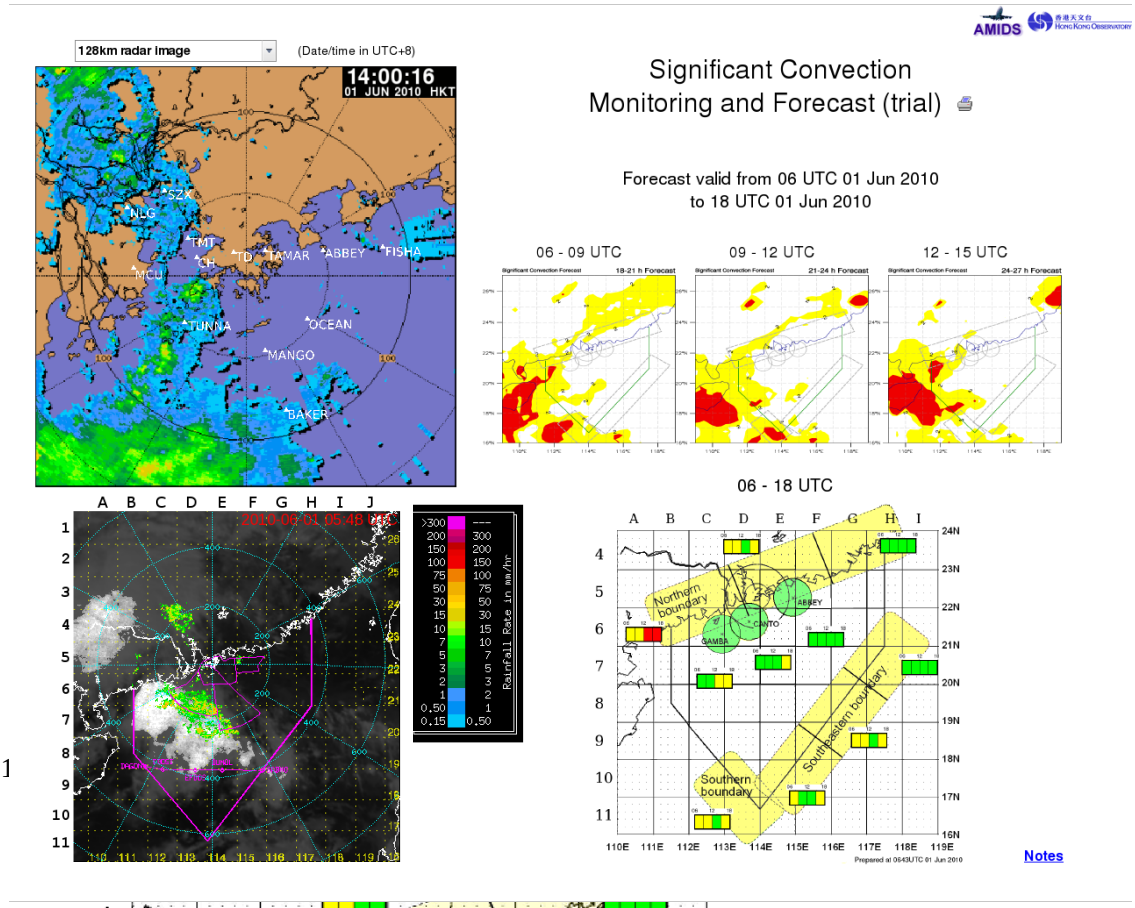
Figure 1



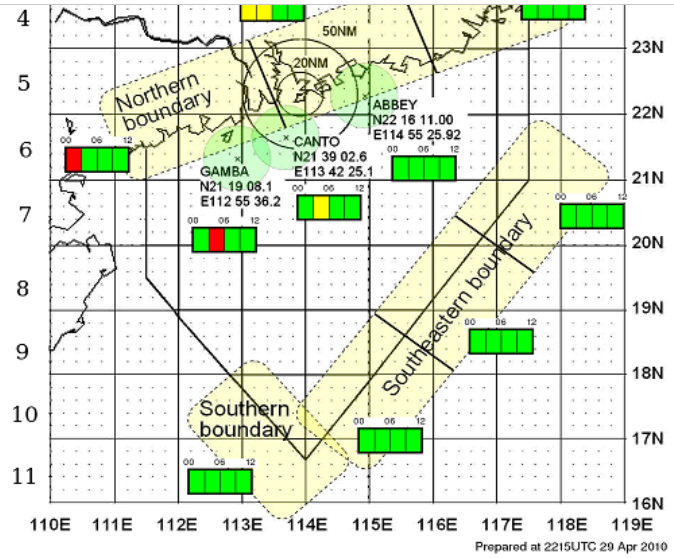
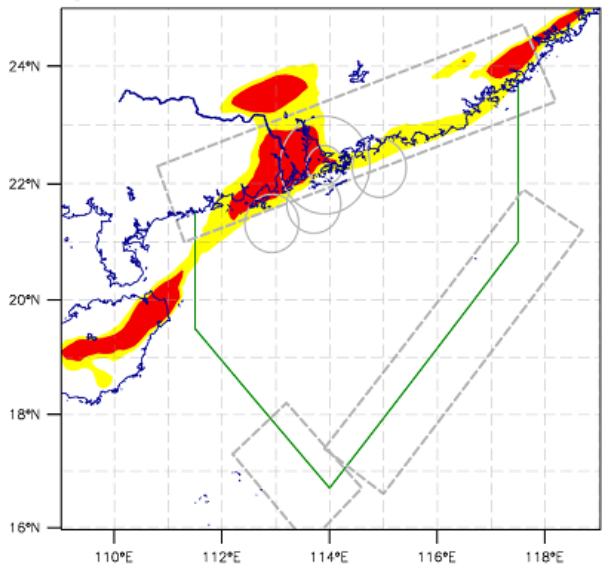




Figure 2. Significant convection time series forecast for the coloured areas at 3-hourly intervals up to 12 hours ahead. Different colours (green / yellow / red) indicate various levels of chance (low / medium / high) of significant convection over the specified area within the 3-hour time block.

(a)




(b)

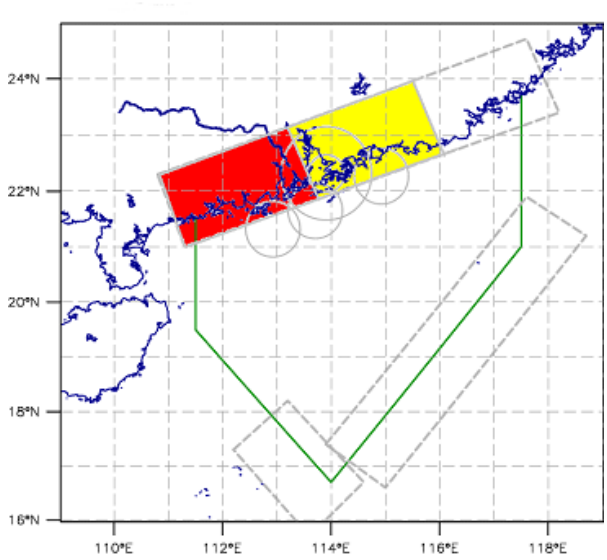



Figure 3. Significant convection forecast in pictorial form : (a) “weather map” without manual adjustment; (b) “areal map” with manual adjustment. Yellow/Red markings indicate a medium/high chance of significant convection over the specified area within a 3-hour time frame.